SOUTENANCE DE THESE

THESIS DEFENSE

Tifenn RAULT

Unité de Recherche **: Laboratoire Heudiasyc, Labex MS2T**

soutiendra sa thèse de **Doctorat** sur le sujet **:**

Energy Saving in Wireless Sensor Networks

A l'Université de Technologie de Compiègne

Le vendredi 2 octobre 2015 à 9h15

Amphi L103 – Centre Pierre Guillaumat

Devant le jury composé de :

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Abstract :

Wireless sensor networks (WSN) are key components of systems of systems (SoS) since they can be integrated in complex assemblies in order to respond to current societal issues such as the aging of the population, the optimization of natural resources and the reduction of carbon footprint. Typically, kinematic sensors can be used to remotely supervise elderly patient, humidity sensors can be deployed to control field irrigation for a more sustainable agriculture, and connected vehicles will help to optimize the management of urban traffic while limiting pollution.

In these contexts, sensor nodes are expected to operate autonomously in unattended area for long periods of time since it is not always possible to manually replenish the motes because of their number,

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the maintenance costs or the inaccessibility of monitored regions. Indeed, sensors are battery-powered devices with stringent resource limitation, especially in terms of energy. The depletion of one component may compromise the operation of the whole network. Therefore, there is a need to develop energy-efficient solutions to increase the network lifetime.

In this thesis, we propose new strategies for energy conservation in wireless sensor networks, so that the operational time of these networks can be extended. The work can be divided into two main focus area, namely general wireless sensor networks, and healthcare-oriented wearable sensor networks. In the first part of this thesis we provide a comprehensive survey of the existing energy-efficient mechanisms. Then, we propose two new solutions: the first one optimizes the displacement of a mobile base station as well as buffer usage and data routing at sensor nodes; the second one optimizes the deployment of wireless chargers in the network to satisfy the energy demand of the sensors. The second part of this thesis is dedicated to healthcare application where wearable sensors are used to remotely supervise a patient. We begin with a state-of-the-art of the energy-efficient techniques existing in the literature. We then introduce a new energy-efficient architecture that allows to optimize the lifetime of both the sensor and the base station. This is a context-aware solution that takes into consideration heterogeneous devices.

Our results show that the lifetime of the sensor networks can be extended using the proposed strategies. All the results obtained are supported by numerical experiments and extensive simulations. For one of them, a testbed is under development.

Publications :

Revue internationale:

T. Rault, A. Bouabdallah, Y. Challal. Energy efficiency in wireless sensor networks : A top-down survey. *Computer Networks, pp 104-122, (67), 2014.*

Conférences internationales :

T. Rault, A. Bouabdallah, Y. Challal, F. Marin. Energy efficient architecture for wearable sensor networks. *In IFIP Wireless Days, Rio de Janeiro, Brazil, pp. 1-8, 2014.*

T. Rault, A. Bouabdallah, Y. Challal, F. Marin. Context-aware energy-efficient wireless sensor architecture for activity recognition. *In IEEE International Conference on Pervasive Computing and Communications Workshops (PERCOM Workshops), Budapest, Hungary. pp. 1-4, 2014.*

T. Rault, A. Bouabdallah, Y. Challal. Multi-hop wireless charging optimization in Low-Power Networks. *In IEEE Global Communications Conference (GLOBECOM), Atlanta, USA, pp. 462-467, 2013.*

T. Rault, A. Bouabdallah, Y. Challal. WSN Lifetime Optimization through Controlled Sink Mobility and Packet Buffering. *In the 5th Global Information Infrastructure and Networking Symposium (IEEE GIIS), Trento, Italy, p. 1-6, 2013.*

Publications soumises dans des revues internationales:

T. Rault, A. Bouabdallah, Y. Challal, F. Marin. A survey of energy-efficient architectures using wearable sensors for activity recognition. *Submitted to Pervasive and Mobile Computing.*

T. Rault, A. Bouabdallah, Y. Challal, F. Marin. Energy-efficient gateway selection strategies for a wearable sensor architecture. *Submitted to Journal of Biomedical and Health Informatics.*